



3. Remediation and Modification Options

Following the determination that the Perris Dam required seismic remediation that will entail a significant amount of construction work, discussions ensued as to what further modifications might be made to the dam or to the operation of the dam and reservoir that could be beneficial. These included options of permanently lowering the reservoirs to levels that might eliminate the need to carry out the foundation remediation and higher and larger reservoirs created by increasing the height of the dam that would provide the benefit of more system storage. The options studied are described briefly in the following paragraphs.

Empty Reservoir: The reservoir will be permanently emptied. A drainage channel will be cut through the dam, the outlet works will be removed or modified, and some of the equipment will be removed and salvaged. The facility will not be used for water supply storage. The Lake Perris State Recreation Area will continue to exist and operate, but there will be no water-based recreational activities.

Reservoir Operating Level Reduced to Elev. 1542 ft. (40,000 AF): The reservoir will be lowered over a programmed period of time to the permanent lower level, after which it will be used for recreational purposes only. It is currently assumed that no remediation of the dam will be required. A new spillway will be constructed at elevation 1542 ft. Water will continue to be fed into the lake and withdrawn at a rate intended to prevent stagnation and provide acceptable recreational water quality. The outlet works will remain and will continue to operate. The outlet tower will be reduced in height to meet seismic criteria. SWC will not use the facility for water supply storage. Recreation facilities will have to be extensively modified because of the change in shoreline location.

Reservoir Operating Level Reduced to Elev. 1563 ft. (72,000 AF): The reservoir operating level will be permanently established at the current temporary level. Remediation of the dam will still be required, perhaps with less construction than required for the base condition. A new spillway will be constructed at approximately elevation 1565 ft. to meet DSOD requirements. The reservoir will continue to be used by the SWC. The inlet will be extended to the northeast end of the reservoir to improve circulation and water quality in the reservoir and of the water withdrawn for water supply. The outlet works will remain and continue to operate, and the outlet tower will be strengthened to meet seismic criteria. Recreation facilities will be permanently modified for the 1563 ft. normal elevation.

Reservoir Operating Level Returned to Elev. 1588 ft. (126,841 AF): The reservoir level will be returned to the as-designed condition. Remediation will consist of removing part of the downstream portion of the dam in the area of weak foundation material, removing the weak foundation material, replacing the foundation and downstream dam material and adding a strengthening berm in that area. It is not currently deemed necessary to add a seepage cutoff wall beneath the dam. The operation of the reservoir will follow the



historical pattern, amended only to meet changing conditions within the water supply system. A secondary inlet may be constructed at the northeast end of the reservoir supplied by the future extension of the IF, which will improve circulation and water quality. The outlet tower will be strengthened to meet seismic criteria. This may require a temporary cofferdam or lowering of the reservoir below the current level of 1563 ft. for access to the lower part of the tower. A new channel will be constructed from the blowoff valve to the Perris storm drain that would provide safe carriage of the required flow for emergency drawdown of the reservoir.

Reservoir Operating Level Raised to Elev. 1640 ft. (nominal 257,000 AF; actual 249,000 AF): A larger reservoir will be created by raising the dam. The remediation of the weak foundation material will be carried out, and a seepage cutoff wall will be added. A conservative approach was taken that assumes that a second dam will be constructed at the northeast end of the reservoir from a base elevation of approximately 1600 ft. to protect Stephens' kangaroo rat (*Dipodomys stephensi*) habitat and other habitat from inundation. This approach will reduce the reservoir storage volume as well as the surface area. The nominal reservoir volume is that which would exist without the northeast dam; the actual volume is somewhat reduced as indicated in parentheses above and for the cases discussed below. Pumped drainage of collected rainfall will be required at the downstream toe of that dam. A saddle dam will also be required at Bernasconi Pass on the south side of the lake. The spillway level will be raised, and an additional inlet will be constructed at the northeast end of the reservoir to improve circulation and water quality. The outlet tower will be replaced with a new higher and stronger tower with additional levels of withdrawal. This will require a temporary cofferdam or lowering of the reservoir below the current level of 1563 ft. for access. The outlet facility, or another supplemental outlet, must be provided with an increased discharge capacity to permit the required emergency drawdown flows to be released. A new channel will be constructed from the blowoff valve to the Perris storm drain that would provide safe carriage of the required flow for emergency drawdown of the reservoir. New recreation facilities will have to be constructed for the higher lake level.

Reservoir Operating Level Raised to Elev. 1706 ft. (nominal 500,000 AF; actual 443,000 AF): This larger reservoir will be created by a higher and larger dam. This option includes all of the construction elements described for the elevation 1640 ft. reservoir level. Inclusion of the Northeast Dam will eliminate the need for a saddle dam at the extreme northeast end of the reservoir that would otherwise be required. The Bernasconi Pass saddle dam is still required.

Reservoir Operating Level Raised to Elev. 1752 ft. (nominal 700,000 AF; actual 586,000 AF): This larger reservoir will be created by a higher and larger dam. This option includes all of the construction elements described for the elevation 1640 ft. reservoir level. Inclusion of the Northeast Dam will eliminate the need for two saddle dams as shown in Figure 3.11 that would otherwise be required. The Bernasconi Pass saddle dam is still required.



Reservoir Operating Level Raised to Elev. 1814 ft. (nominal 1,000,000 AF; actual 792,000 AF): This larger reservoir will be created by a higher and larger dam. This option includes all of the construction elements described for the elevation 1640 ft. reservoir level. Inclusion of the Northeast Dam will eliminate the need for three saddle dams as shown in Figure 3.13 that would otherwise be required. The Bernasconi Pass saddle dam is still required.

The basic data for all of the dam and reservoir options with and without the northeast dam are contained in Table 3.1. The changes in reservoir volume with the northeast dam in place for the larger reservoirs are listed in Table 3.2. Figure 3.1 shows the area-capacity curves for both the conditions without (original) and with the northeast dam, illustrating the amount of inundation that will be prevented by the construction of the Northeast Dam. The cross-section of the existing dam is shown in Figure 3.2. Figure 3.3 provides an aerial view of the dam and reservoir with the pertinent elevations outlined around the shoreline. Figures 3.3 through 3.14 are aerial views of the reservoir as it would look with normal maximum reservoir elevations varying from the smallest to the largest reservoirs studied. Small saddle dams are shown where appropriate. These are circled in yellow in Figures 3.9, 3.11, and 3.13. Simplified dam cross-sections for the base case dam and the enlarged dams are shown in Figures 3.15 through 3.19 for comparison of the relative sizes of the dams. In all cases of raising the dam, it is expected that the existing dam will be incorporated in the raised dam.



Table 3.1 Data on Reservoir Options

RESERVOIR ELEVATION FT.	RESERVOIR VOLUME 1000 AC.FT.	RESERVOIR SURFACE AREA ACRES	SPILLWAY CREST ELEV. FT.	DAM CREST ELEVATION FT.	DAM HEIGHT FT.	MAIN DAM VOLUME MIL.CU.YDS.	SADDLE DAMS VOLUME MIL.CU.YDS.	NORTHEAST DAM VOLUME MIL.CU.YDS.	SADDLE DAM VOL.W/NE DAM MIL.CU.YDS.	ALL DAMS VOL. W/O NE DAM MIL.CU.YDS.	ALL DAMS VOL. W/NE.DAM MIL.CU.YDS.	REQ.EMERG. DRAWDOWN FLOW CFS
1480(1)	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1542	40	1350	1544	1600	128	N/A	N/A	N/A	N/A	N/A	N/A	400
1563(2)	72	1720	1565	1600	128	N/A	N/A	N/A	N/A	N/A	N/A	710
1588(3)	127	2292	1590	1600	128	25	N/A	N/A	N/A	25	25	1210
1640	257	3200	1642	1652	180	49	N/A	3	N/A	49	52	2460
1706	500	4200	1708	1718	246	91	1	16	0	92	107	4630
1752	700	4550	1754	1764	292	129	4	43	1	132	171	6100
1814	1000	5000	1816	1826	354	190	12	89	2	201	279	8340

NOTES:

1. This is the no reservoir option
2. This is the current dam safety drawdown reservoir option
3. This is the base, as-designed reservoir option



Table 3.2 Area and Volume Effects of Northeast Dam

	WITHOUT NORTHEAST DAM		CHANGE FROM ORIG. DESIGN		WITH NORTHEAST DAM		WITH NORTHEAST DAM	
RESERVOIR ELEVATION FT.	RESERVOIR VOLUME 1000 AC.FT.	RESERVOIR SURFACE AREA ACRES	RESERVOIR VOLUME 1000 AC.FT.	RESERVOIR SURFACE AREA ACRES	RESERVOIR VOLUME 1000 AC.FT.	RESERVOIR SURFACE AREA ACRES	RESERVOIR VOL. REDUCED 1000 AC.FT.	INUNDATION AREA REDUCED ACRES
1480(EMPTY)	0	0	-127	-2292	0	0	0	0
1542	40	1350	-87	-942	40	1350	0	0
1563	72	1720	-55	-572	72	1720	0	0
1588	127	2292	0	0	127	2292	0	0
1640	257	3200	130	908	249	2800	8	400
1706	500	4200	373	1908	443	3100	57	1100
1752	700	4550	573	2258	586	3200	114	1350
1814	1000	5000	873	2708	792	3300	208	1700

NOTE: Area and volume changes due to the proposed Northeast Dam are approximate.

C:\Projects\Ferris\area-capacity.dwg, Area-Capacity Curves (The Original & With Northeast Dam) Rev 1, 5/30/2006 8:37:41 AM, nguyet01, \\BEL-10667\Rainbow-NT

NOTE:

1. AREAS SAVED FROM SUBMERGENCE BY THE CONSTRUCTION OF THE NORTHEAST DAM ARE APPROXIMATE.

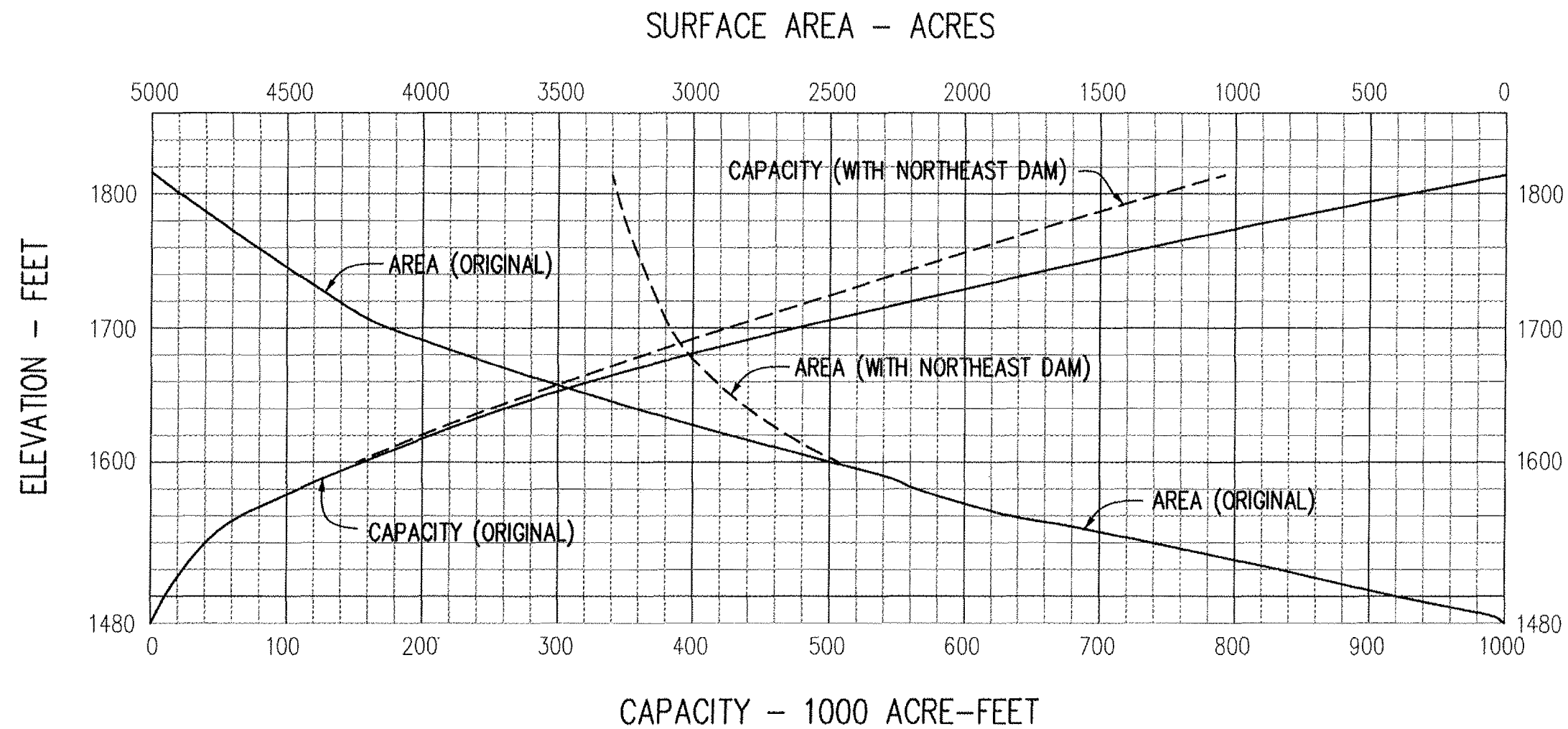
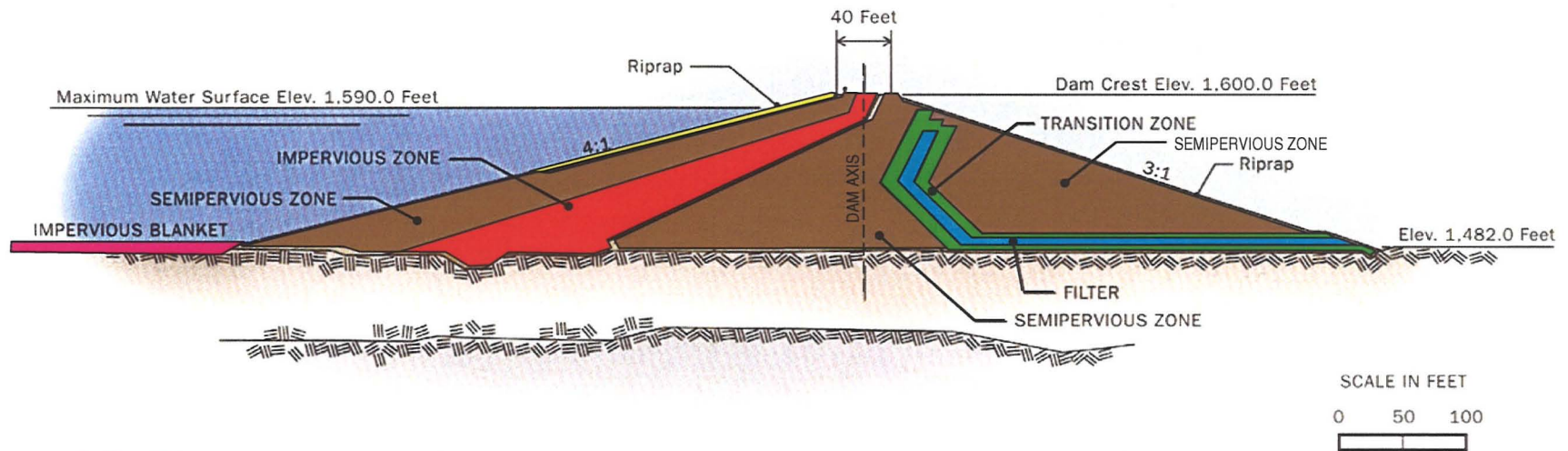


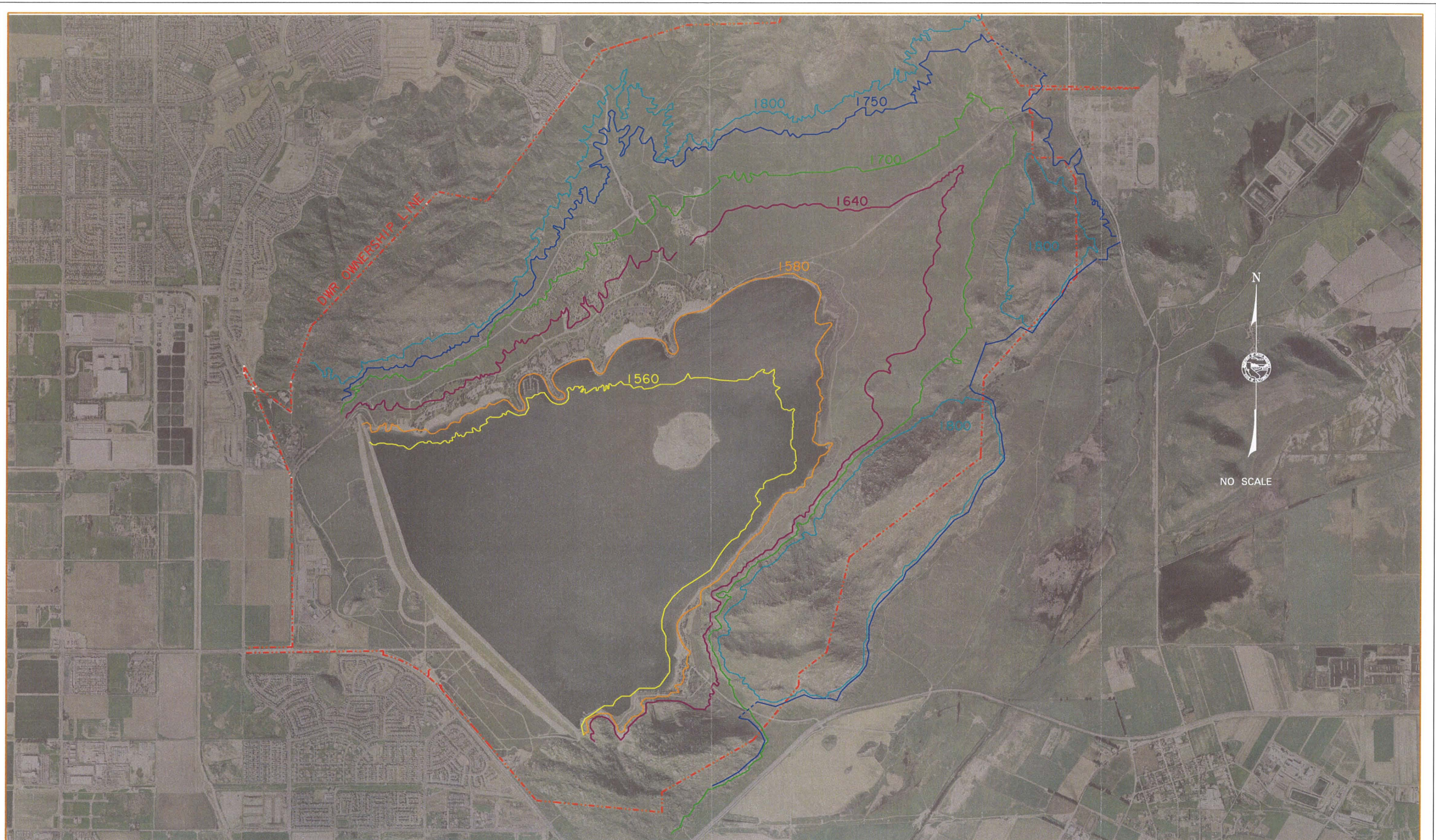
FIGURE 3.1

PERRIS DAM RECONNAISSANCE STUDY	
AREA-CAPACITY CURVES ORIGINAL AND WITH NORTHEAST DAM	
SCALE: 1" = 100'	CHKD: _____
DESIGNED: GR	APPROVED: _____
DRAWN: DTN	_____
FIGURE NO. 3.1	DATE: 05/30/2006



Figure 3.2 Dam Cross Section – As-Designed Dam





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STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF ENGINEERING – GEODETIC BRANCH

LAKE PERRIS RECONNAISSANCE STUDY
VARIOUS ELEVATIONS

Figure 3.3
Aerial View of Dam and
Reservoir



Figure 3.4 Superimposed Aerial Photo – Reservoir at Elev. 1542 ft.

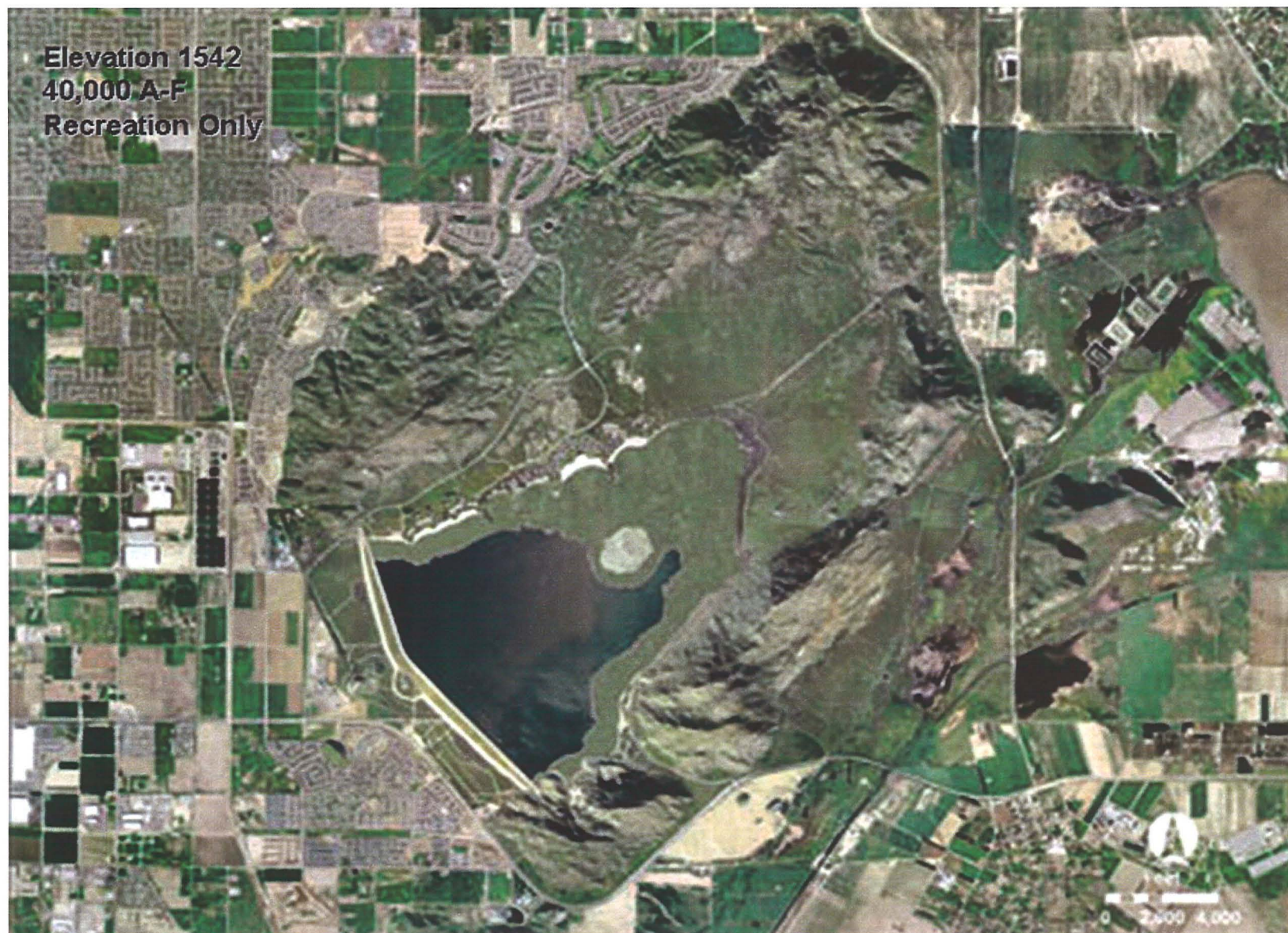




Figure 3.5 Superimposed Aerial Photo – Reservoir at Elev. 1563 ft.

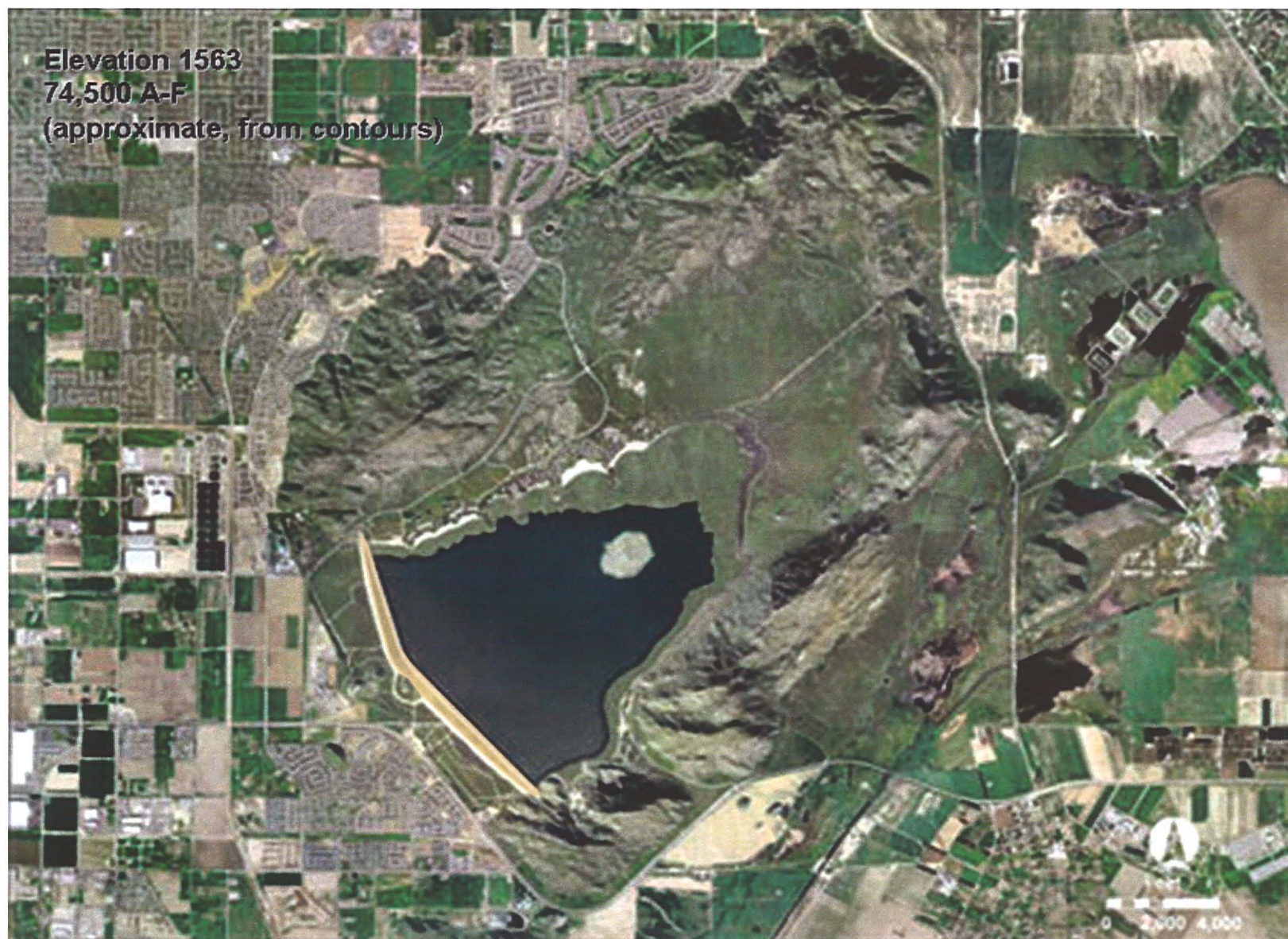


Figure 3.6 Superimposed Aerial Photo – Reservoir at Elev. 1588 ft.

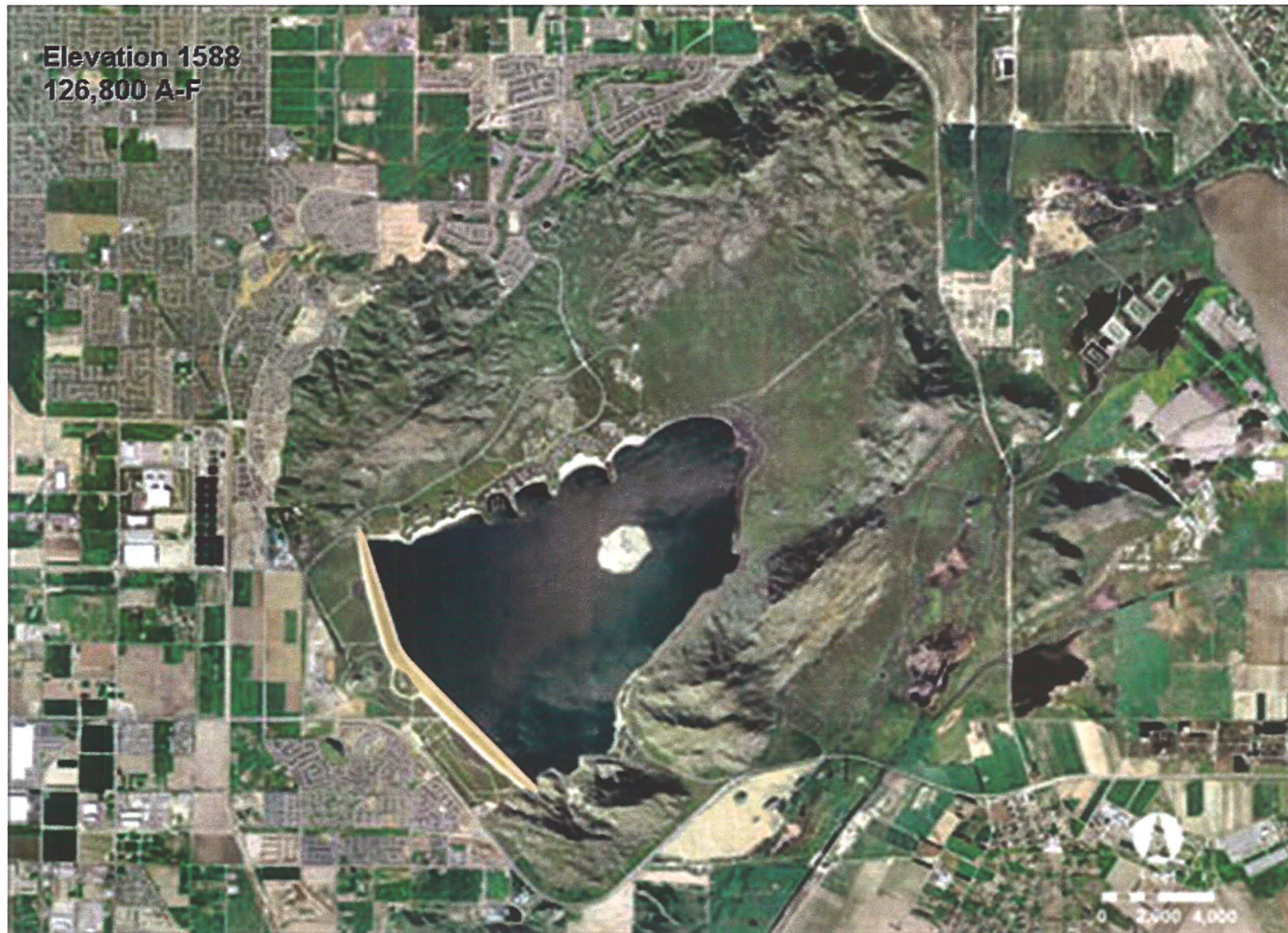


Figure 3.7 Superimposed Aerial Photo – Reservoir at Elev. 1640 ft.

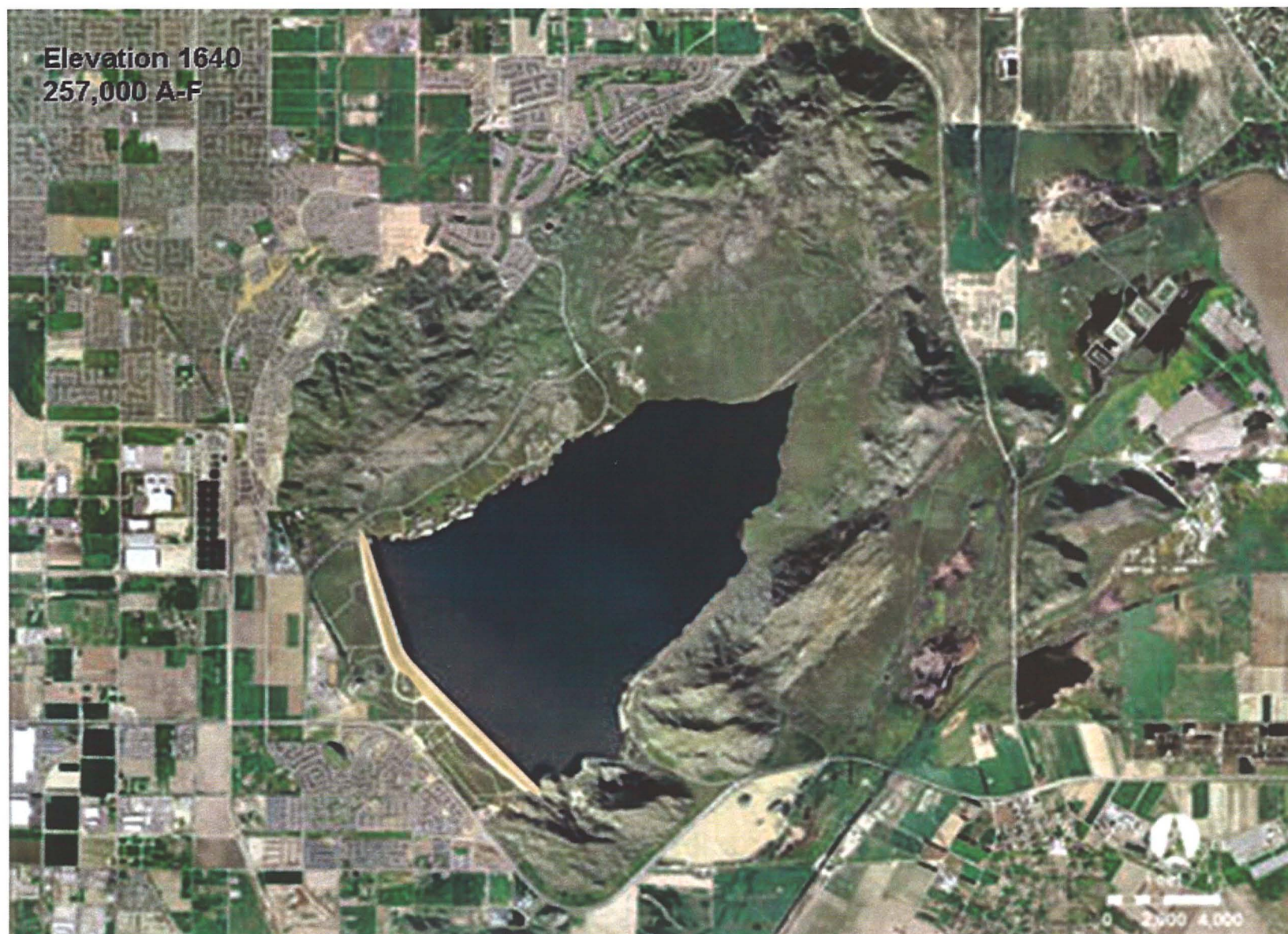




Figure 3.8 Map Showing Northeast Dam – Reservoir at 1640 ft.

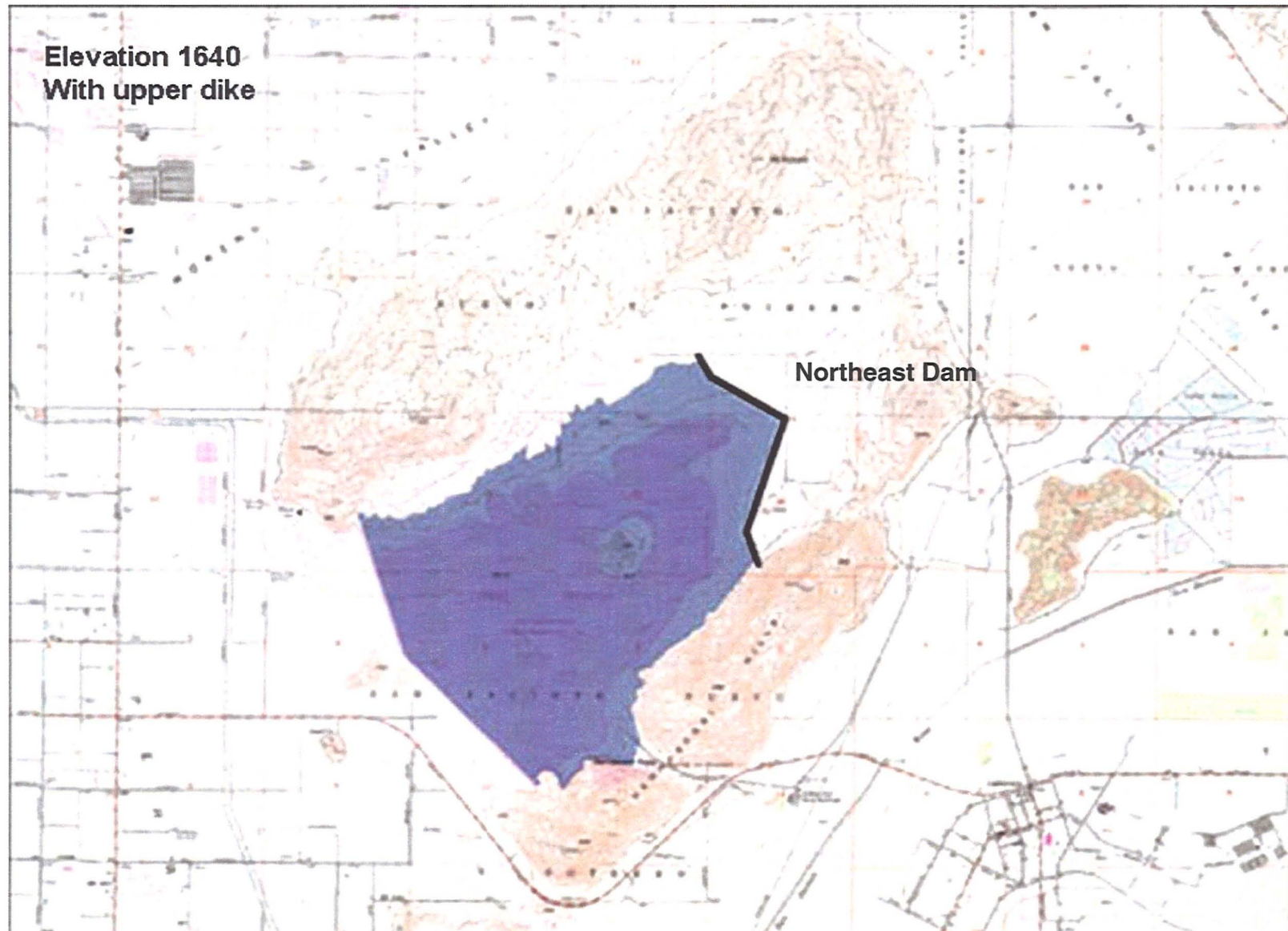


Figure 3.9 Superimposed Aerial Photo – Reservoir at Elev. 1706 ft.

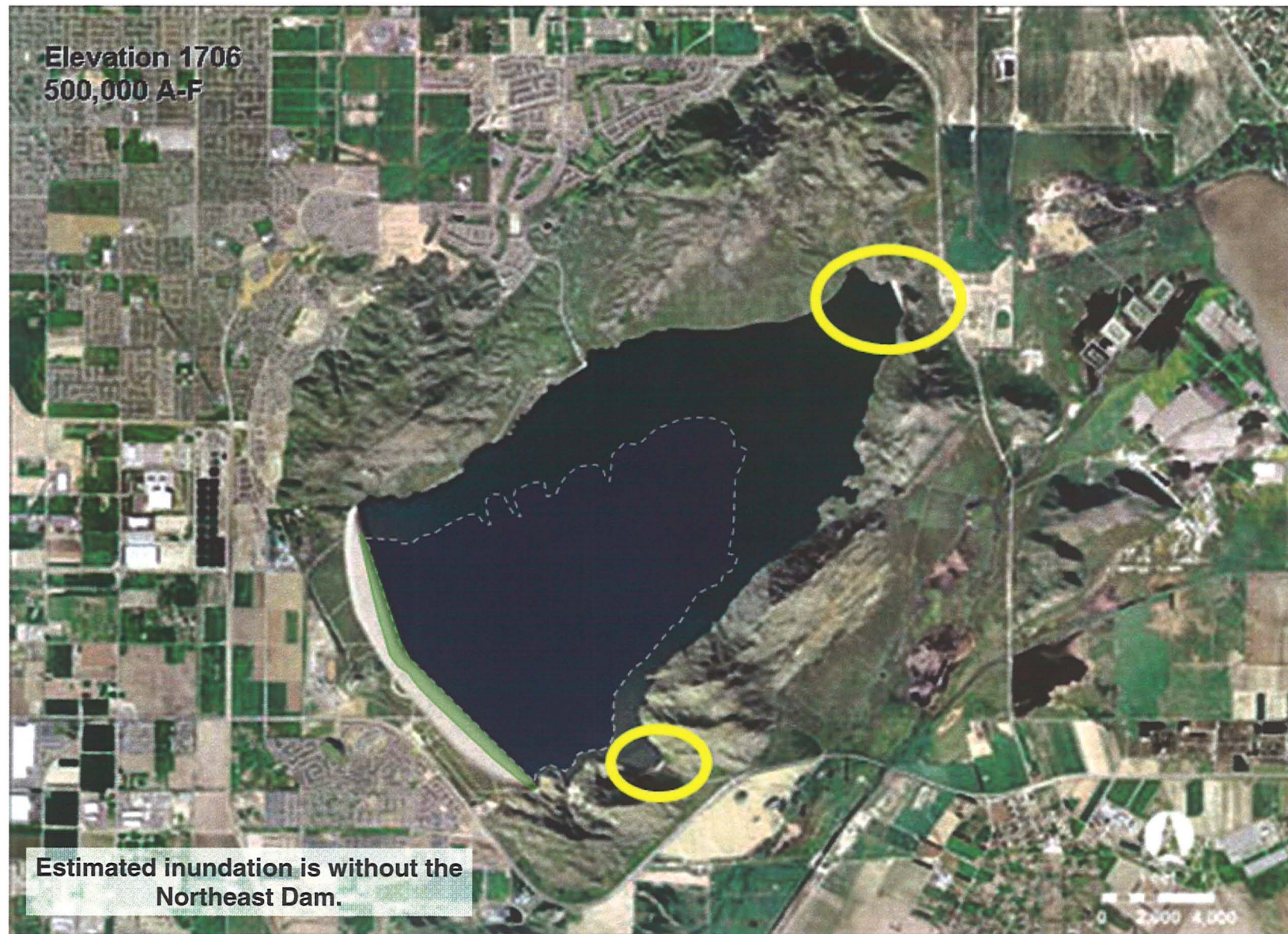


Figure 3.10 Map Showing Northeast Dam – Reservoir at 1706 ft.

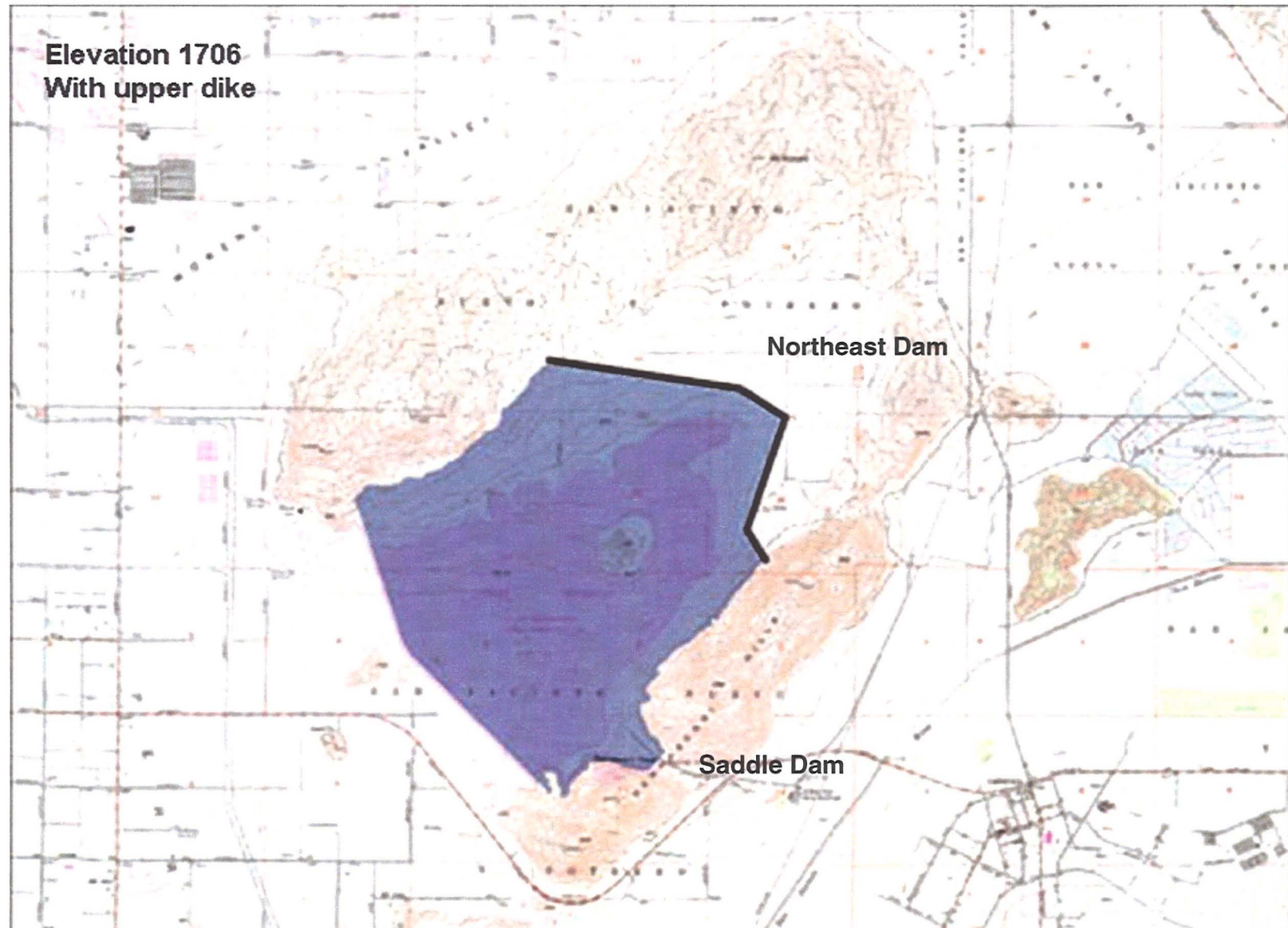


Figure 3.11 Superimposed Aerial Photo – Reservoir at Elev. 1752 ft.

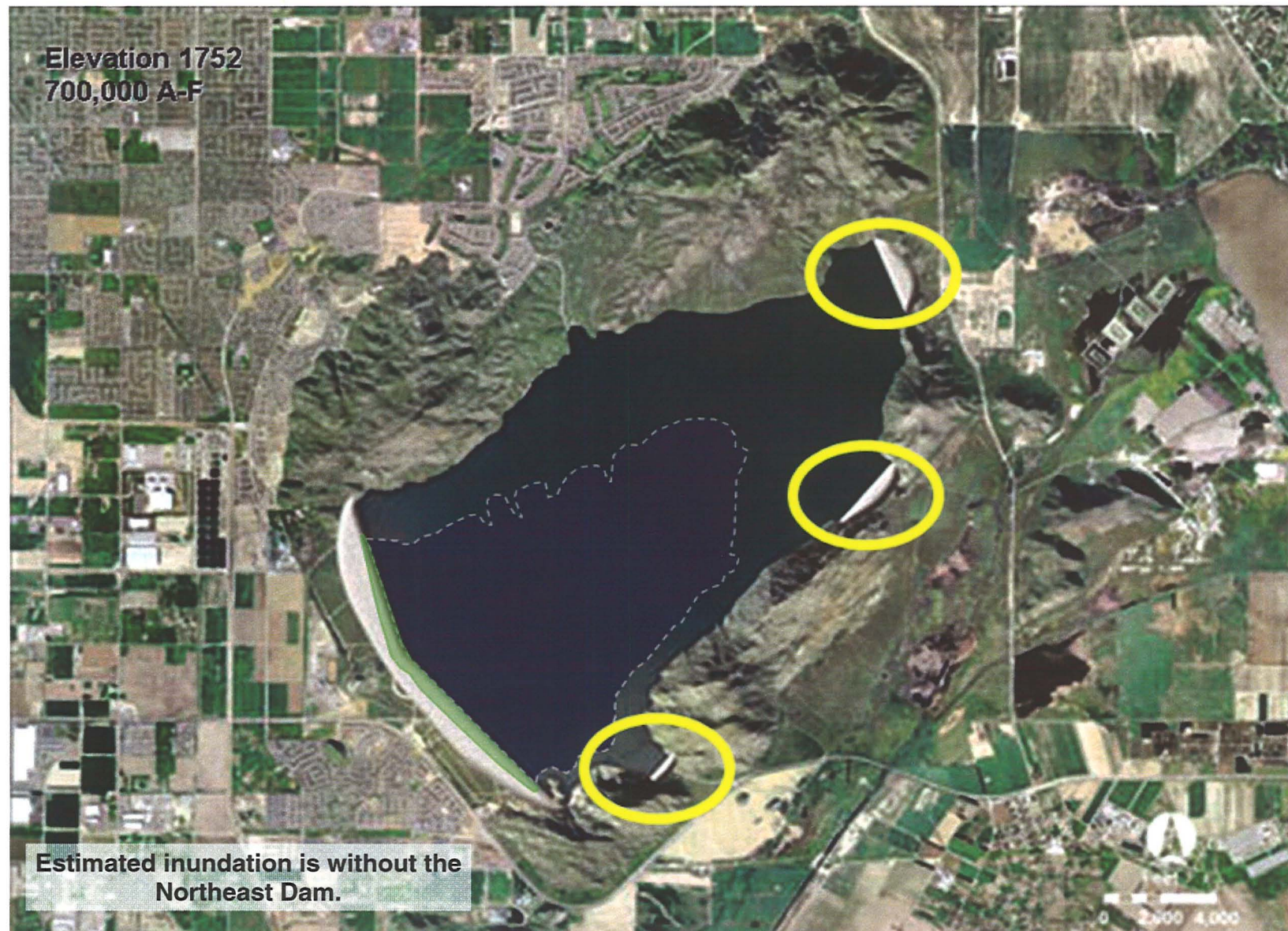


Figure 3.12 Map Showing Northeast Dam – Reservoir at 1752 ft.

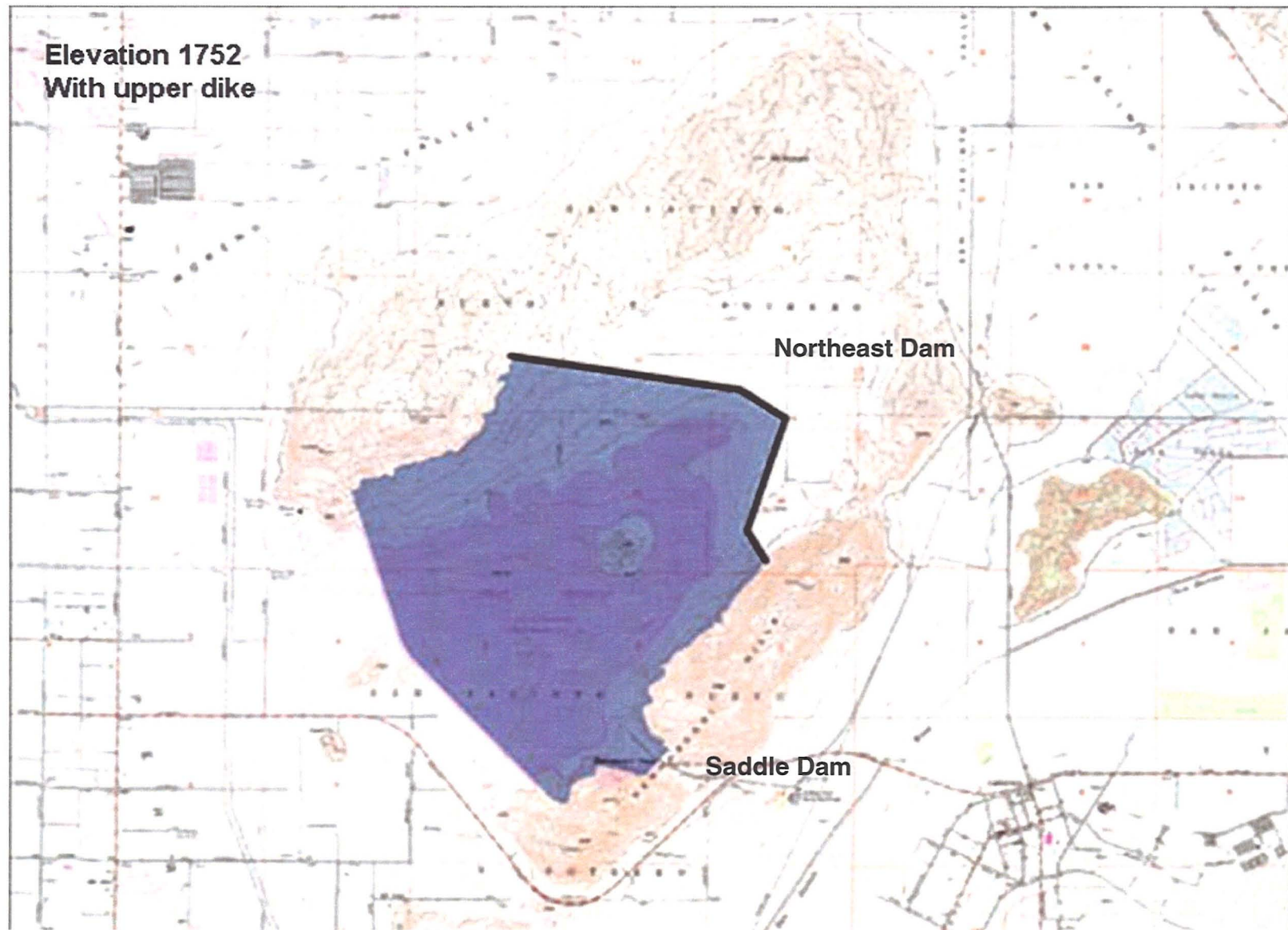


Figure 3.13 Superimposed Aerial Photo – Reservoir at Elev. 1814 ft.

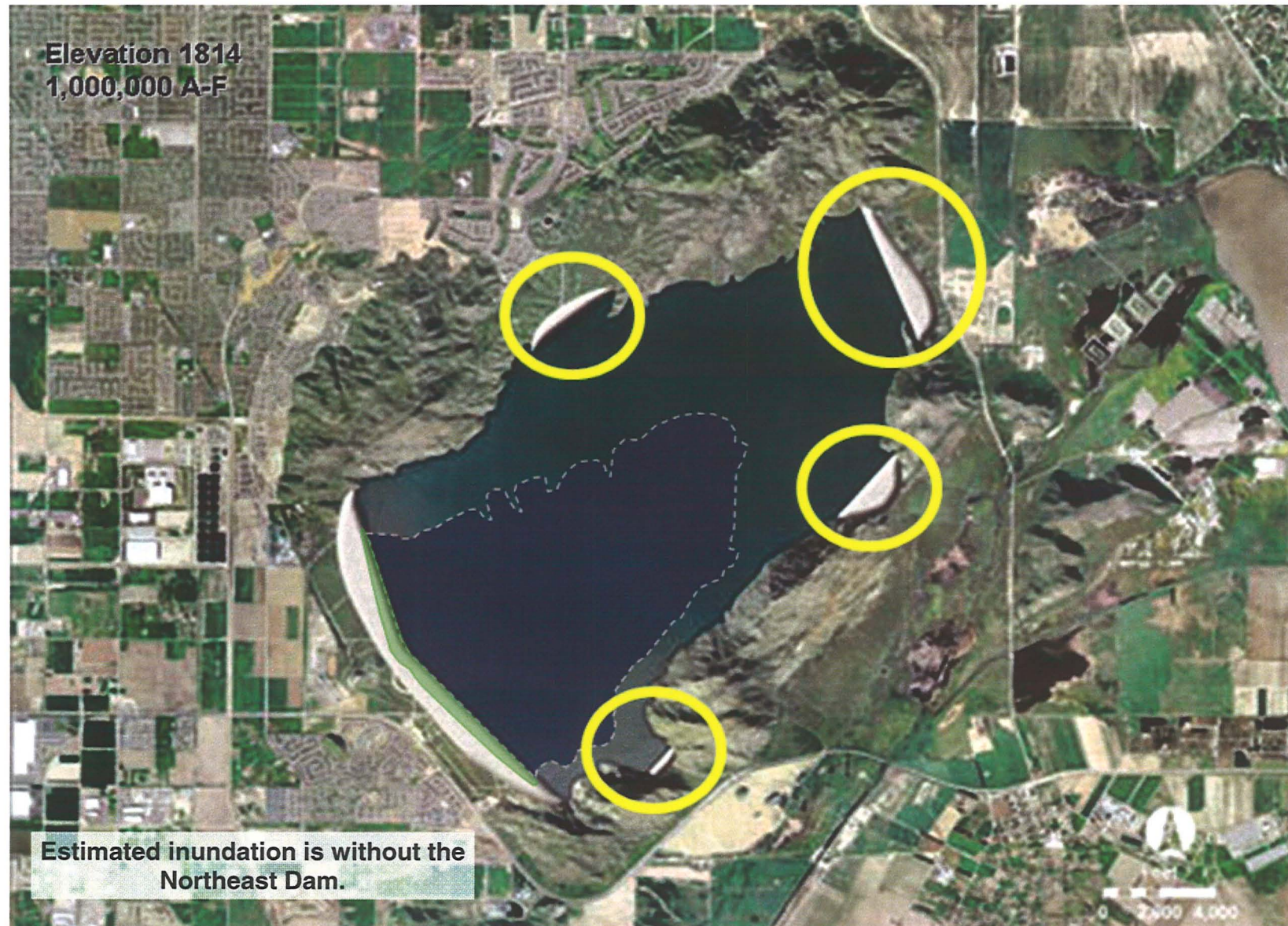




Figure 3.14 Map Showing Northeast Dam – Reservoir at 1814 ft.

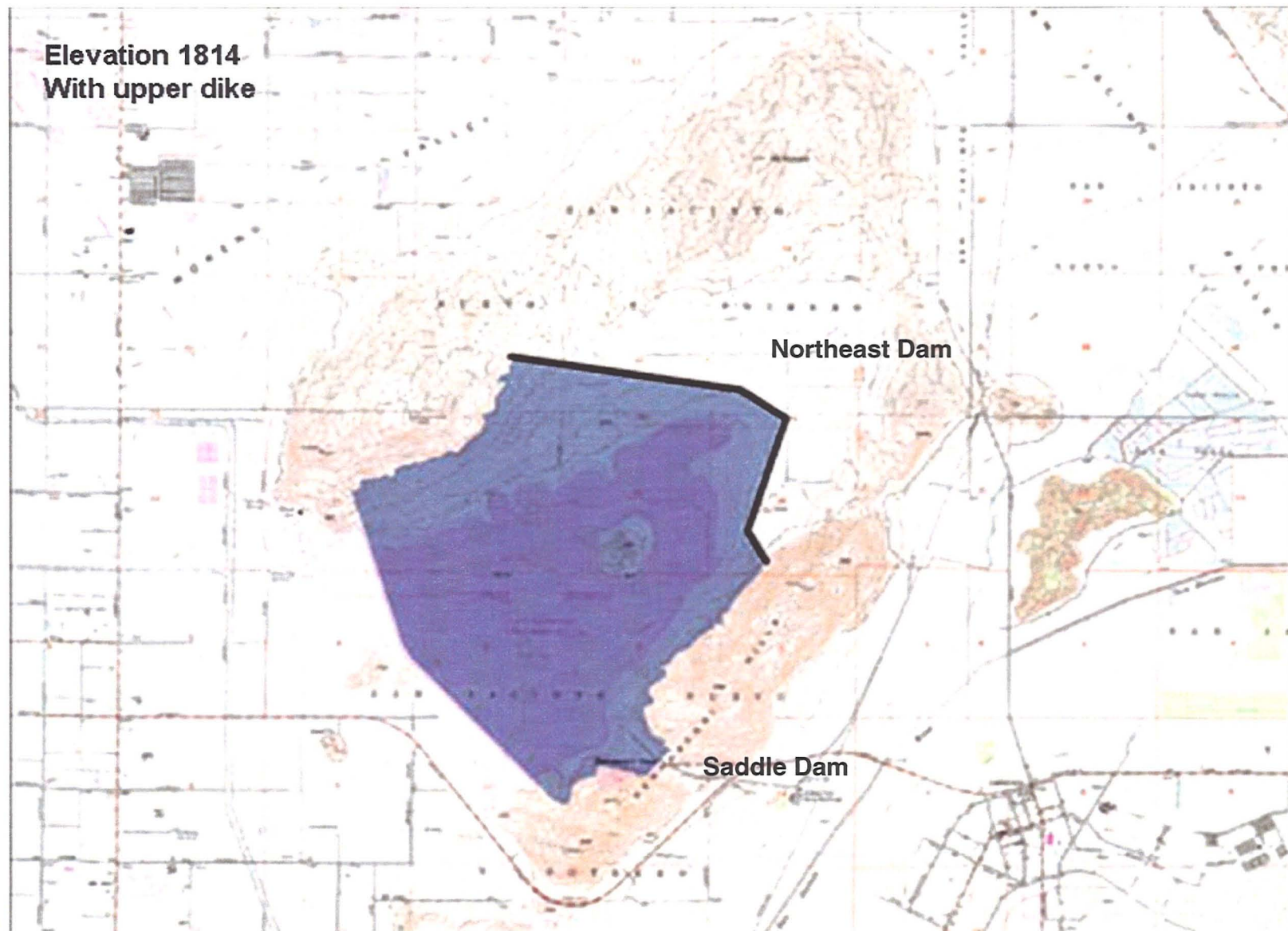
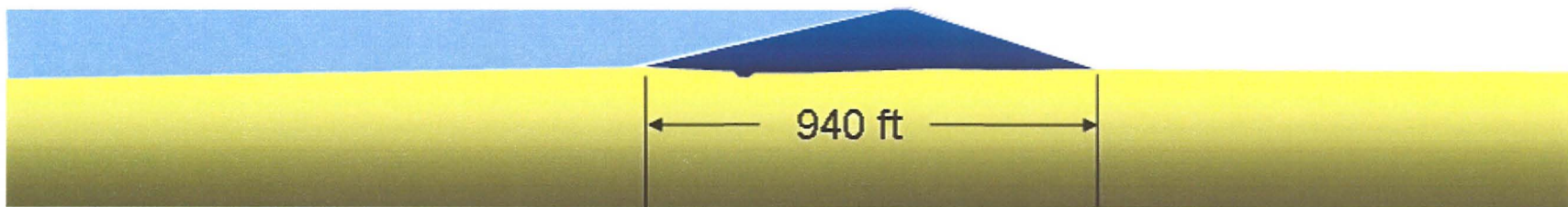




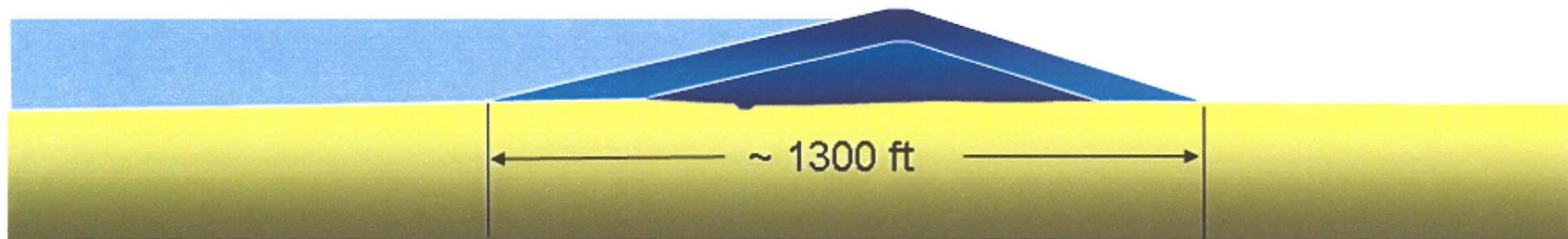
Figure 3.15 Dam Cross Section – Reservoir at Elev. 1588 ft.



Perris Dam Reconnaissance Study

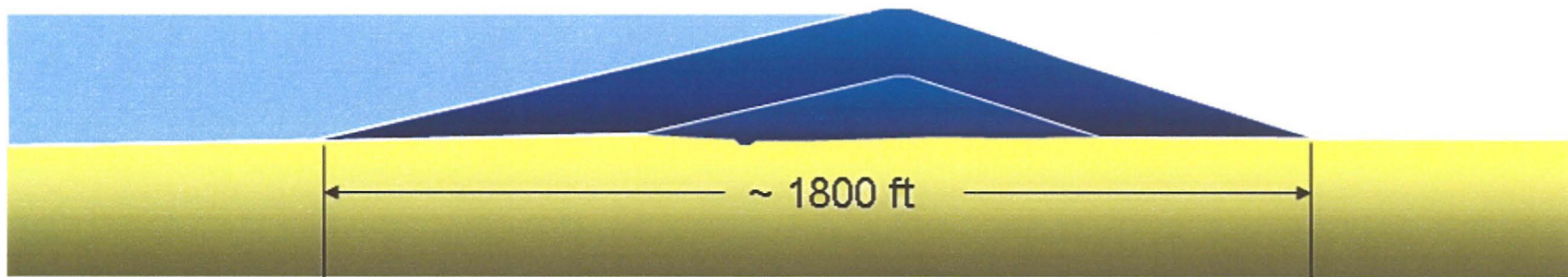


Figure 3.16 Dam Cross Section – Reservoir at Elev. 1640 ft.



Perris Dam Reconnaissance Study

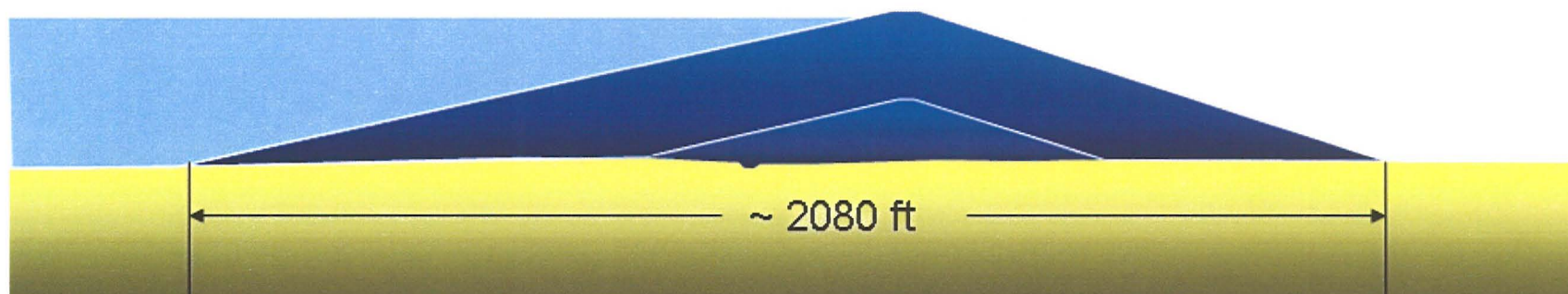
Figure 3.17 Dam Cross Section – Reservoir at Elev. 1702 ft.



Perris Dam Reconnaissance Study



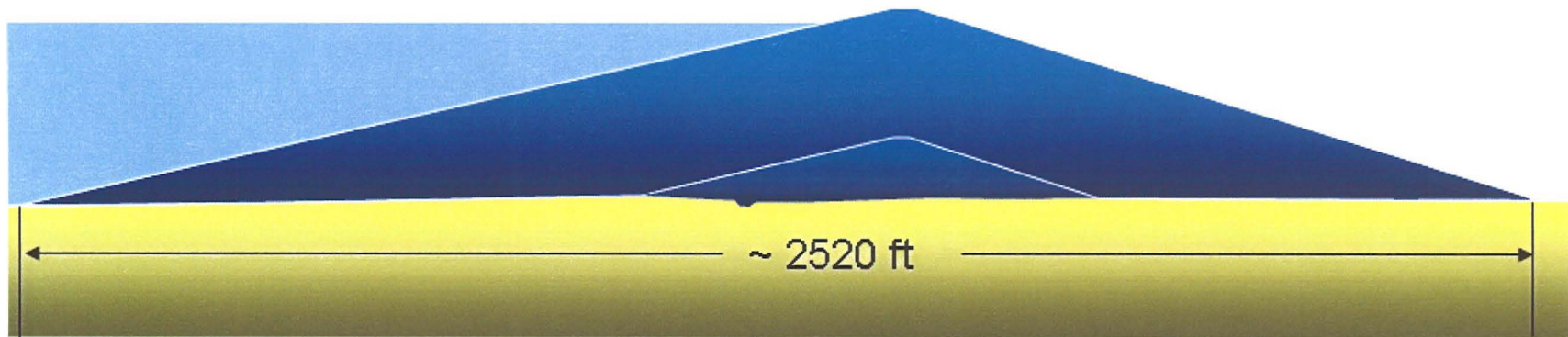
Figure 3.18 Dam Cross Section – Reservoir at Elev. 1752 ft.



Perris Dam Reconnaissance Study



Figure 3.19 Dam Cross Section – Reservoir at Elev. 1814 ft.



Perris Dam Reconnaissance Study